

REMARKS

Reconsideration of this application is respectfully requested in view of the foregoing amendment and the following remarks.

By the foregoing amendment, claims 1, 5 and 7 have been amended, and claim 9 has been canceled without prejudice or disclaimer for filing in a continuation application. Thus, claims 1-8 are currently pending in the application and subject to examination.

In the Office Action dated November 20, 2006, claims 1-8 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fossum et al. (US Patent No. 6,456,326, hereinafter, "Fossum") in view of Anderson et al. (US Patent No. 6,498,623, hereinafter, "Anderson"). Claim 9 was also rejected under 35 U.S.C. § 103(a) as being unpatentable over Fossum in view of Anderson. It is noted that claims 1, 5 and 7 have been amended, and claim 9 has been canceled. To the extent that the rejections remain applicable to the claims currently pending, the Applicants hereby traverse the rejections, as follows.

In the Applicants' invention as recited in independent claims 1, 5 and 7, as amended, an integration period of the plurality of rows of pixels is shifted with respect to each other.

In the Applicants' invention as recited in independent claim 1, as amended, a sample hold circuit is disposed in each one of column lines; a vertical scan circuit generates vertical scan signals to sequentially select a plurality of row select lines; and a horizontal scan circuit generates horizontal scan signals to sequentially select an output of a sample hold circuit, wherein the vertical scan circuit sequentially selects and

scans the plurality of row select lines within a first vertical scan period when the image sensor is controlled to a first frame period, and also sequentially selects and scans the plurality of row select lines within the first vertical scan period even when the image sensor is controlled to a second frame period, which is longer than the first frame period, and an integration period of the plurality of rows of pixels is shifted with respect to each other.

In the Applicants' invention as recited in independent claim 5, as amended, a sample hold circuit is disposed in each one of column lines for sample holding photoelectric conversion signals of the pixels; a vertical scan circuit generates vertical scan signals to sequentially select the plurality of row select lines; and a horizontal scan circuit generates horizontal scan signals to sequentially select an output of the sample hold circuit while each one of the row select lines is selected, wherein the vertical scan circuit sequentially selects and scans the plurality of row select lines within a first vertical scan period when the image sensor is controlled to a first frame period, and also sequentially selects and scans the plurality of row select lines within the first vertical scan period even when the image sensor is controlled to a second frame period, which is longer than the first frame period, and an integration period of the plurality of rows of pixels is shifted with respect to each other.

In the Applicants' invention as recited in independent claim 7, as amended, a sample hold circuit is disposed in each one of column lines for sample holding photoelectric conversion signals of pixels; a vertical scan circuit generates vertical scan signals to sequentially select the plurality of row select lines; and a horizontal scan circuit generates horizontal scan signals to sequentially select the output of the sample

hold circuit while each one of the row select lines is selected, wherein the vertical scan circuit sequentially selects and scans the plurality of row select lines within the vertical scan period which is a part of the frame period, and does not select the row select lines outside the vertical scan period in the frame period, and an integration period of the plurality of rows of pixels is shifted with respect to each other.

The amendments to claims 1, 5 and 7 clarify a rolling shutter function of the CMOS image sensor recited in these claims. The image sensor, as recited in claims 1, 5 and 7, as amended, has a plurality of row select lines that are sequentially selected, and a sample hold circuit that holds the image signal of plural pixels in a row when that row line is selected. Therefore, each row of pixels has its own integration period, i.e., exposure period, and sample-hold period, and such integration period for each row is shifted with respect to each other. Such an operation is a "rolling shutter function." A moving image is distorted by a rolling shutter function because of the shifted integration periods of the rows.

On the other hand, CCD image sensors have a global shutter function. A CCD image sensor has a plurality of rows of pixels that are sequentially arranged in a column direction to form a pixel matrix. In a CCD image sensor, all pixels are exposed during the same period, and image signals of each row of pixels are repeatedly shifted to the next row to output the image signals. A CCD image sensor does not have row select lines and column lines. A moving image is not distorted by the global shutter function of a CCD image sensor because the exposure period for all pixels is the same.

The outstanding Office Action takes the position that Fossum discloses all of the features of the claimed invention with the exception of the vertical scan circuit also

sequentially selecting and scanning the plurality of row select lines within the first vertical scan period even when the image sensor is controlled to a second frame period, which is longer than the first frame period. Anderson is cited as allegedly curing the deficiencies that exist in Fossum.

However, Anderson discloses a CCD image sensor, whereas Fossum discloses a CMOS image sensor. Thus, the image sensors of Anderson and Fossum have completely different structures and operations. Accordingly, it would not be obvious to one of ordinary skill in the art to combine the driving method of the CCD image sensor of Anderson with the MOS-type image sensor of Fossum.

Moreover, the Office Action asserts that Anderson teaches at col. 2, lines 31-42, that it is preferable to scan the rows in a first vertical period even when the frame length is increased in order to correct for image brightness. See, Office Action, p. 3. However, at col. 2, lines 31-42 Anderson teaches only that the frame length may be too short to accommodate a necessary exposure time, or may be too short for the camera to complete data shifting before the beginning of the next frame. Anderson teaches that therefore, frame skipping is used, so that the effective frame length is doubled or tripled, for example. Anderson does not disclose or suggest at col. 2, lines 31-42, or anywhere else, scanning the plurality of rows in a first vertical scan period regardless of the frame length.

Neither Fossum nor Anderson, alone or combined, discloses or suggests a vertical scan circuit sequentially selects and scans said plurality of row select lines within a first vertical scan period when said image sensor is controlled to a first frame period, and also sequentially selects and scans said plurality of row select lines within

said first vertical scan period even when said image sensor is controlled to a second frame period, which is longer than said first period, and wherein an integration period of the plurality of rows of pixels is shifted with respect to each other, as recited in claim 1, as amended.

For at least this reason, the Applicants submit that independent claim 1 is allowable over the applied art of record. As claim 1 is allowable, the Applicants submit that claims 2-4 and 8, which depend from allowable claim 1, are likewise allowable for at least the reasons set forth above with respect to claim 1.

Similarly to as described above with respect to claim 1, the Applicants submit that claim 5 is allowable at least because neither Fossum nor Anderson, alone or combined, discloses or suggests a sample hold circuit disposed in each one of said column lines for sample holding photoelectric conversion signals of said pixels; a vertical scan circuit for generating vertical scan signals to sequentially select said plurality of row select lines; and a horizontal scan circuit for generating horizontal scan signals to sequentially select an output of said sample hold circuit while each one of said row select lines is selected, wherein said vertical scan circuit sequentially selects and scans said plurality of row select lines within a first vertical scan period when said image sensor is controlled to a first frame period, and also sequentially selects and scans said plurality of row select lines within said first vertical scan period even when said image sensor is controlled to a second frame period, which is longer than said first frame period, and wherein an integration period of the plurality of rows of pixels is shifted with respect to each other, as recited in claim 5, as amended.

As claim 5 is allowable, the Applicants submit that claims 6 and 8, which depend from allowable claim 5, are likewise allowable for at least the reasons set forth above with respect to claim 5.

With respect to claim 7, the CMOS image sensor has the rolling shutter function, where while one row is subject to the read out operation, other rows are subject to exposure, i.e. integration. Therefore, in the prior art, the vertical scan is performed within a whole period of frame period. However, in claim 7, the vertical scan is performed within a part of the frame period.

In CCD image sensor, all pixels are simultaneously subject to the exposure period and transfer period. Therefore, because of such structure, CCD image sensor of Anderson transfers image signals in the pixel array within a part of frame period.

However, the CMOS image sensor has the different structure and different operation. Therefore, claim 7, CMOS image sensor, is not obvious for skilled person from Anderson, because of such different shutter mechanism.

For at least this reason, the Applicants submit that independent claim 7 is allowable over the applied art of record. As claim 7 is allowable, the Applicants submit that claim 8, which depends from allowable claim 7, is likewise allowable for at least the reasons set forth above with respect to claim 7.

Conclusion


For all of the above reasons, it is respectfully submitted that the claims now pending patentability distinguish the present invention from the cited references. Accordingly, reconsideration and withdrawal of the outstanding rejections and an issuance of a Notice of Allowance are earnestly solicited.

Should the Examiner determine that any further action is necessary to place this application into better form, the Examiner is invited to contact the undersigned representative at the telephone number listed below.

In the event this paper is not considered to be timely filed, the Applicants hereby petition for an appropriate extension of time. The Commissioner is hereby authorized to charge any fee deficiency or credit any overpayment associated with this communication to Deposit Account No. 01-2300 referencing client matter number **108066-00090**.

Respectfully submitted,

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Enclosures: Petition for Extension of Time